Joint pain in children

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Abstract

Joint pain is a common complaint in children and occasionally — although rarely — a symptom of serious disease. It can affect up to 20% of children at any one time. We have attempted to present important points in the history, examination and investigation to help the clinician dealing with a child presenting with non-traumatic joint pain to distinguish those at risk of serious pathology from those children with a benign cause. We also present a management plan in the form of a flow chart for the children who present to the emergency department with a painful joint.

Keywords arthritis; children; joint pain; limp

Introduction

Joint pain and swelling are common manifestations of many musculoskeletal, rheumatologic and other systemic diseases in children. As a result the differential diagnosis of childhood joint pain and swelling is large and includes both benign and serious conditions. The majority of these children will have a benign diagnosis however important and serious conditions like the septic joint, non-accidental injury and cancer should always be considered.

This article provides an overview of the important medical and surgical causes of acute non-traumatic joint pain in children. We also aim to provide a framework to the clinician for the clinical assessment of a child with joint pain to help ensure that serious conditions are not missed.

History

Trauma is the commonest cause of joint pain in children presenting to emergency department but it usually poses little diagnostic challenge. It is often difficult to determine the underlying process when there is no associated traumatic incident. A comprehensive history is the most important factor in determining whether the symptoms are a result of a benign condition or a more serious underlying process. This can be challenging as there is often a 'red herring' report of a preceding trauma offered by the parents. The younger the child, the more important it is to obtain a comprehensive social history in order to explore potential risk factors for inflicted injury due to child abuse.

The age and sex of the patient can narrow the spectrum of diagnoses that need to be considered (Table 1). Also the mode of onset whether acute or insidious can help to pinpoint a specific disease pattern. If the child has had previous episodes of joint pain, a chronic disease process is a more likely cause than injury or infection. As already pointed out, a history of injury cannot necessarily be relied on as diagnostic and the clinician needs to maintain a high level of suspicion of the possibility of another non-traumatic cause. A preceding or concurrent illness manifested by a sore throat or viral symptoms may support the diagnosis of reactive arthritis. A recent vaccination (e.g. for rubella) may also be significant (serum sickness) as can be a positive travel history, exposure to tick bites and other features of illness; skin rashes (psoriasis, lupus erythematodes), gastrointestinal symptoms (inflammatory bowel disease) and chronic fevers may suggest a systemic process, whereas lack of physical changes often indicates a more benign condition.

The location of the pain helps to decide whether its origin is intra-articular or extra-articular. The timely pattern of the pain can help to distinguish inflammatory from mechanical conditions. Inflammatory pain is usually worse in the morning and improves with activity, whereas mechanical pain worsens with activity. If the pain comes and goes in a few minutes or hours, it is less likely to be significant than if it persists for days or weeks. A summary of important points to consider in history taking is shown in Table 2.

Differential diagnosis based on the age of a child

Common causes of joint pain in children
All ages

- Trauma (fracture, haemarthrosis, soft tissue)
- Infection (septic arthritis, osteomyelitis, discitis)
- Secondary to various viral illnesses
- Tumour
- Sickle cell disease
- Serum sickness

Toddler (1—3 years)	Child (4—10 years)	Adolescent (11—16 years)
• Transient synovitis • Toddlers' fracture • Child abuse • Developmental dysplasia of the hip • Juvenile arthritis (pauciarticular) • Neuromuscular disease • Haemophilia • Henoch—Schoenlein purpura	• Transient synovitis • Juvenile arthritis (pauciarticular) • Perthes' disease • Rheumatic fever • Haemophilia • Henoch—Schoenlein purpura	• Slipped upper femoral epiphysis • Overuse syndromes • Osteochondritis dissecans

Table 1

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Important points to consider while taking history

- Age
- Sex
- Mode of onset (acute or insidious)
- Any previous episodes of joint pain
- Current or preceding illness or injury
- Recent vaccination
- Location, pattern, and duration of pain
- Joint swelling, rash, or fever
- Recent travel
- Contact with infectious disease

Table 2

Examination

Effective and thorough musculoskeletal examination will reduce the number of investigations required. It should start with general physical examination of the patient. Pain score and level of discomfort before and after the administration of analgesia should be recorded. Vital signs should be measured and recorded. Thereafter a quick musculoskeletal screening assessment can be performed using pGALS (paediatric Gait, Arms, Legs and Spine) before making a full regional assessment of the affected limb.

This assessment should include inspection, palpation (check for temperature difference), passive and active movement and appropriate functional assessment. A joint above and below should also be examined. Distal neurovascular status should be assessed and recorded. A full systemic examination may be indicated.

Below is a list of some benign and red flag symptoms and signs for the patients presenting with joint pain. It can be used as a guide to distinguish between benign and serious conditions.

Benign symptoms

- Worse with activity and better with rest
- Worse at the end of the day
- If night pain, relieved with simple analgesia/rubbing by parent, fully resolved by the next morning

Summary of investigations which may be required in case of a child presenting with joint pain

Test	Diagnostic value of the test
FBC	A normal WCC is present in 24%—74% of septic arthritis cases. Sensitivity and specificity of raised white cell count for septic arthritis are 75% and 55% respectively.
ESR	ESR becomes elevated up to 48 hours after the start of inflammatory process. It can be normal in 25% of septic arthritis cases. The sensitivity of ESR on admission in picking up osteoarticular infections is 94%.
CRP	CRP becomes elevated within 6 hours of inflammatory process. Sensitivity of elevated CRP on admission is 95%.
Blood Film	A normal blood film does not exclude malignancy and bone marrow aspirate may be required.
Blood Culture	Blood cultures are positive in 46%—80% of patients with osteomyelitis and 22%—50% of patients with septic arthritis.
Antistreptolysin O titre (ASOT)/anti-DNAse-B	Raised ASOT suggests current or recent streptococcal infection and is present in up to 80% of patients with acute rheumatic fever. Sensitivity can be further increased by testing for additional antibodies such as anti-DNAse-B. Throat swab also indicated but often negative.
Lactate dehydrogenase (LDH)	Raised levels can suggest malignancy (especially lymphoma) but sensitivity and specificity is low.
Plain radiography	Diagnostic yield is low in young children (1—5 years) who have an otherwise normal examination. May be normal even with significant pathology (e.g. sepsis, early Perthes' disease, transient synovitis, malignancy, juvenile idiopathic arthritis). Repeat radiographs after a period of review may be useful (e.g. detecting periosteal reaction in Toddler's fracture or evolving Perthes' disease). Anterior—posterior and 'frog leg lateral' hip X-rays should be undertaken in all children to detect early slipped upper femoral epiphysis (SUFE).
Ultrasonography	Very sensitive in detecting hip and joint effusions. Operator-dependent. Absence of effusion on hip USS makes septic arthritis very unlikely.
MRI	Very sensitive in identifying early sepsis, Perthes' disease, inflammatory disease and tumours when the pathological area is localized on clinical examination. May not always be able to differentiate infection from inflammation. Sedation/anaesthesia may be required in younger patients.
Bone scan	Very sensitive in identifying early osteomyelitis when an obvious focus of infection cannot be localized. May also detect early Perthe's disease, tumours, Toddler's fractures.
CT	Useful to detect early bone changes of sepsis and tumours and may detect occult fractures, but significant exposure to ionizing radiation.

Table 3

Benign signs

- No joint swelling
- Joint hyper mobility
- No bony tenderness
- Normal strength
- Normal height and weight growth

Red flag symptoms suggestive of serious condition

- Fever
- Malaise
- Morning joint stiffness or pain
- Night pain refractory to simple analgesia and symptomatic during the daytime

Red flag signs suggestive of serious condition

- Joint swelling
- Bony tenderness to palpation
- Muscle weakness
- Fall in height or weight growth curve

Investigations

Judicious and targeted investigations should be carried out to rule out specific diseases. X-ray is usually a first line investigation especially in case of suspected trauma. A CT-scan can be performed to further delineate the bone pathology especially in cases of suspicious bone lesions. MRI may be helpful to investigate unexplained focal pain lasting more than two weeks. The diagnosis of infection can be aided by blood tests, including full blood count, C-reactive protein, erythrocyte sedimentation rate but these tests are non-specific. The diagnosis of septic arthritis and osteomyelitis should not be based on blood results alone as inflammatory markers can be entirely normal in the early stages of the disease process. Therefore, a high index of suspicion is required to diagnose these conditions and appropriate follow-up and review of the patient is an essential part of the management if a minimalist approach to testing is to be taken. Joint aspirate microscopy and culture is the gold standard for the diagnosis of septic arthritis. There are no diagnostic blood tests for juvenile idiopathic arthritis (JIA). Anti-nuclear antibodies are only helpful in assessing the risk of uveitis in JIA and rheumatoid factor is present in just 5% of cases of JIA. Rheumatologic screening tests merely assist in the categorizing rheumatological joint disease and may help to refine prognosis but overall their positive and negative predictive value is poor. A peripheral blood film is essential when leukaemia is suspected. Investigation for lymphoma requires wider radiological investigation of chest and abdomen. In patients less than 4 years of age spinal pain may be due to neuroblastoma requiring urinary catecholamines analysis. Ultrasound scan can be useful for intra-articular pathology like synovitis, especially if it is difficult to determine the affected joint or when the hip joints are affected. Investigations that may be required in cases of joint pain in children are summarized in Table 3.

Summary table for the investigations and management of children presenting with joint pain

Diagnosis	Features	Investigations	Management
Septic arthritis/ osteomyelitis	Fever Systemic upset Severe limitation of joint movements Beware of subtle presentation	FBC, CRP, ESR USS and guided joint aspiration X-ray may show signs of osteomyelitis	Urgent Orthopaedic input May need joint washout and I/V antibiotics
Joint trauma	History of trauma Signs of injury	X-ray/CT scan	Inpatient/outpatient management depending on the type and cause of injury
Irritable hip	Systemically well	FBC, CRP, ESR	Advise regular analgesia for 48 hours Follow up in 7–10 days
Henoch–Schoenlein purpura	Purpuric rash Abdominal pain Haematuria	Urine dipstick and microscopy Blood pressure	Paediatric referral and follow up
Haemarthrosis	If spontaneous of after minor injury consider haemophilia	Coagulation studies	Paediatric referral if clotting abnormal
Rheumatic fever	Carditis Erythema marginatum Migrating polyarthritis Subcutaneous nodules Chorea	ECG/ECHO FBC, U&E, CRP, ESR, ASOT, DNase B	Refer to paediatrics
Serum sickness	History of medication use Rash	Bloods as above	Follow up in 7–10 days
Reactive arthritis	History of recent viral illness Well child	Exclude septic arthritis	Follow up in 7–10 days

Table 4

Kocher's criteria for septic arthritis and risk stratification of septic arthritis using Kocher's criteria

Kocher's criteria

- History of a fever > 38.5 C
- The child is not weight bearing
- ESR > 40 mm/h
- Serum WCC > 12 × 10^9/Liter

Number of Kocher's criteria present	Risk of septic arthritis
0	0.2
1	3
2	40
3	93
4	99

Table 5

Management

Management of a child presenting with joint pain depends on the differential diagnosis considered. Table 4 summarizes the most common conditions and their management.

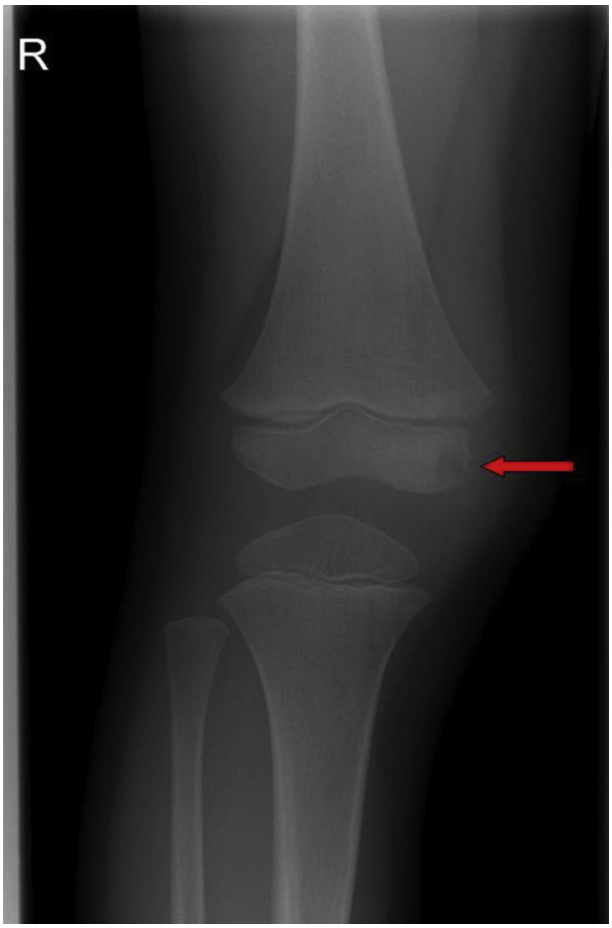

Figure 1 Osteomyelitis right knee. Clearly showing periosteal reaction and abscess formation.

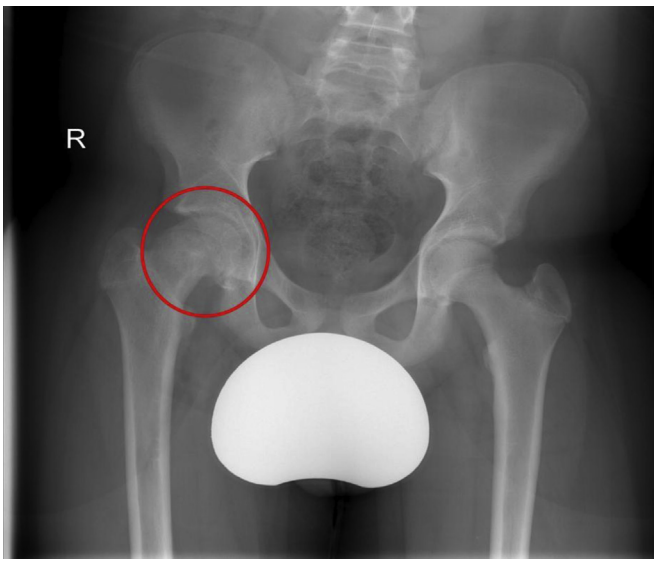

Figure 2 SUFE right hip. Clearly showing slipped upper femoral epiphysis.

We will now discuss in a little more detail the approach and management of a few specific conditions that typically present to primary care or the emergency department with a painful joint.

Septic arthritis

Septic arthritis can destroy a joint within 24 hours. It is most important to rule this condition out in any child who presents with pyrexia, pain or inability to weight bear. In younger patients the symptoms and signs can be very subtle. Septic arthritis can present in the neonatal period and clinical signs may be limited to the child just not moving a limb. Kocher's criteria are often used with a view to differentiate between transient synovitis and septic arthritis in older children (Table 5). Radiographs are often normal on presentation but can show changes of joint destruction with progressive disease (Figure 1).

Children with two or more of Kocher's criteria have between 40% and 99% chance of having septic arthritis and should be admitted for further management. Patients with one or none of the criteria have less than 3% chance of having septic arthritis and alternative diagnosis should be considered. Although useful

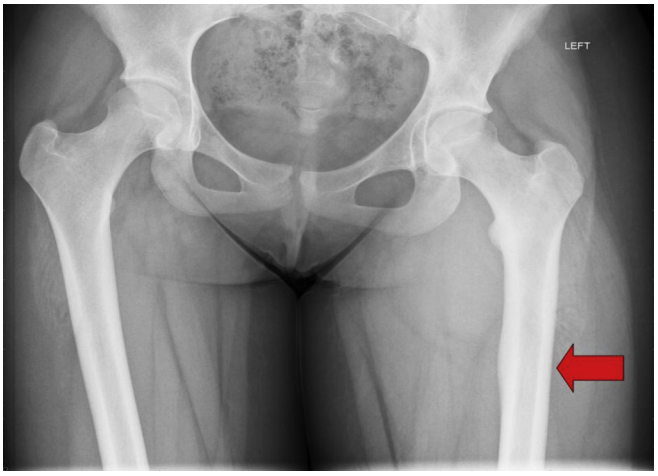

Figure 3 Ewing sarcoma left thigh.

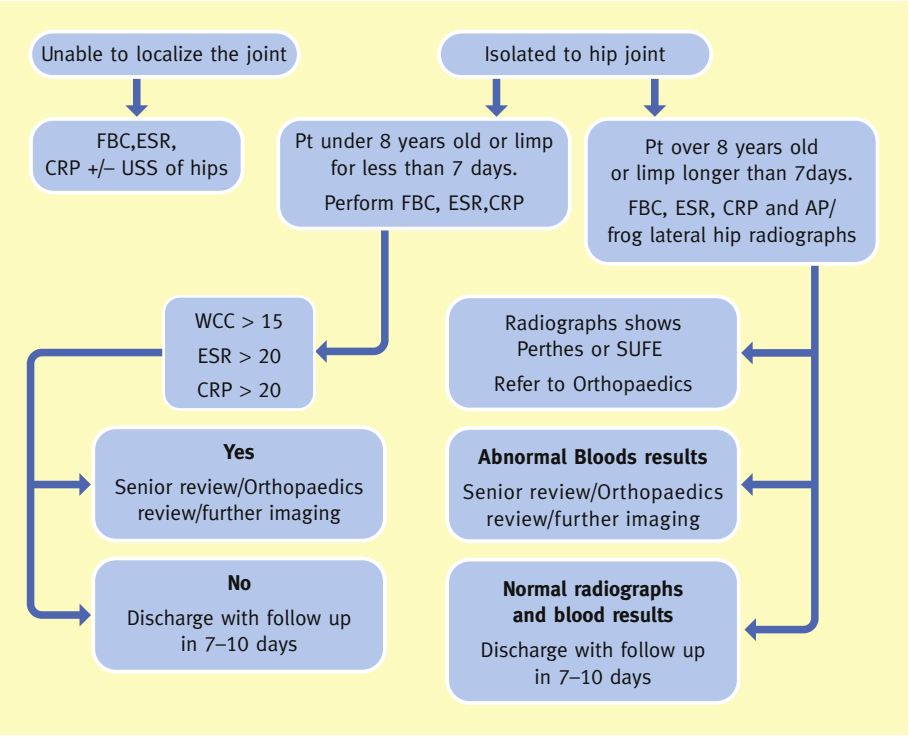

Figure 4 Flow chart for the management of joint pain.

in the older, ambulant child, Kocher's criteria probably do not apply to the non-mobile infant.

Transient synovitis

It is a relatively common problem, especially in children between the ages of 3- and 6-year-old which is usually self-limiting within approximately one week. There is a higher incidence in boys than girls.

- Rapid onset of hip pain and limping in an otherwise well child, often on waking in morning
- +/− history of preceding viral illness
- Hip held in flexion and abduction, limitation of internal rotation
- Only mild reduction of hip movements

The challenge in these cases is not to over investigate. Reassurance and symptomatic treatment with non-steroidal anti-inflammatory drugs is often all that is required in this self limiting condition. The parents need to be clear when to seek medical input again in case of deterioration or lack of improvement within the typical timeframe.

Slipped upper femoral epiphysis (SUFE)

Slipped upper femoral epiphysis (SUFE) tends to occur in 10—15-year-old, often with body weight above the 90th centile. Boys are affected slightly more often than girls and nearly a quarter of patients have bilateral disease. There may or may not be a history of minimal trauma. Diagnosis is radiological (Figure 2).

- Boys:Girls = 2:1
- 25% may be bilateral
- AP views alone may miss subtle changes therefore bilateral 'frog view' is required

It is essential to make a positive diagnosis in these patients as immediate orthopaedic consultation is required to consider surgical fixation of this condition in order to prevent progression and possible involvement of the contralateral side.

Musculoskeletal neoplasms

Malignant tumours of the musculoskeletal system (sarcomas) are notoriously difficult to detect (Figure 3) and definitive diagnosis is often delayed by months from the onset of symptoms. Initial X-rays and blood tests may be normal hence thorough history and examination, including deep palpation of the affected limb should form part of the assessment. It is this group of patients that will most benefit from scheduled review and further investigations like an MRI scan in case of persistence of symptoms and no definitive alternative diagnosis (Figure 4).

Summary

Joint pain in children is a common presentation in both primary and secondary care. The majority of these patients have benign conditions but there are some important and serious conditions not to be missed. Detailed history taking and thorough examination are more important than 'screening' tests in ruling out serious conditions. The findings will focus investigations and guide further management. There are a number of conditions that constitute emergencies; they include joint infection, neoplasms, inflicted injury and slipped upper femoral epiphysis. Use of risk stratification criteria to guide further management will reduce the number of diagnostic procedures. Most other conditions can be managed with a watchful waiting approach and instructions to carers defining clear criteria for urgent review when further investigations may be considered. ◆

FURTHER READING

1 Caird MS, Flynn JM, Leung LY, Millman JE, D'Italia JG, Dormans JP. Factors distinguishing septic arthritis from transient synovitis of the hip in children. *J Bone Joint Surg* 2006; **88A:** 1251–7.
2 Cassidy James T, Petty Ross E. Textbook of paediatric rheumatology. 5th edn. Saunders, 2005.
3 Kocher MS, Zurakowski D, Kasser JR. Differentiating between septic arthritis and transient synovitis of the hip in children: an evidence-based clinical prediction algorithm. *J Bone Joint Surg Am* 1999; **81:** 1662–70.
4 Maddison PJ, Isenberg DA, Woo P, Glass DN, Breedveld F. Oxford textbook of rheumatology. Oxford: Oxford University Press, 2004.
5 Rogers MJ, Wainwright AM. Wilkinson NMR. Acute painful joints. *Paediatrics Child Health* 2009; **20:** 51–7.
6 Suggested web site for pGALS assessment, http://www.arthritisresearchuk.org.

Practice points

- Thorough history taking and examination is important in differentiating between serious and benign conditions leading to joint pain
- Consider non-accidental injury as a possible cause of joint pain
- Pyrexia and inability to weight bear equals septic joint unless proven otherwise
- Blood tests may be normal, even in cases of inflammatory, infectious and neoplastic joint pain
- Safety netting (scheduled review of patient/informed parents) is an important part of the management of painful joints in children